

# Economic evaluation of HPV vaccine introduction in the Republic of Moldova

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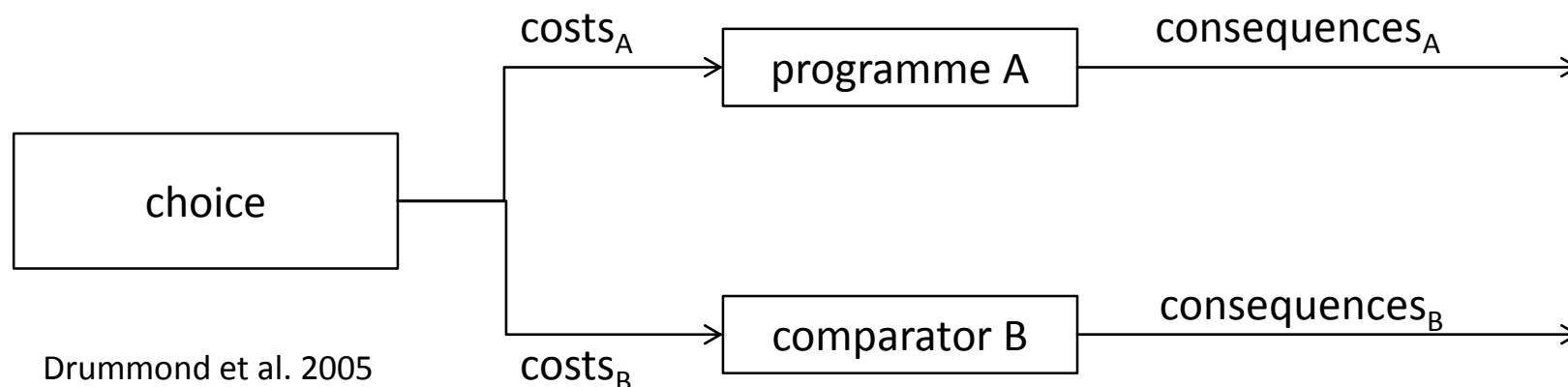
- The Government of Moldova plans to introduce HPV vaccines over the coming years with support from Gavi
- Economic evaluations provide a structured approach to understanding the costs and the consequences of alternative interventions
- WHO supports countries with the development of tools that help to estimate costs and consequences of HPV vaccination
- This study used WHO tools (C<sub>4</sub>P and Prime) to estimate the costs and the cost-effectiveness of HPV vaccine introduction in Moldova

# Questions when introducing a new intervention

- What does it cost?
- What are the benefits?
  - Does it lead to health improvement?
  - Does it lead to savings of resources?
  - Does it have other effects?
- Making informed decisions about resource use in health care (ideally) requires answers to both questions

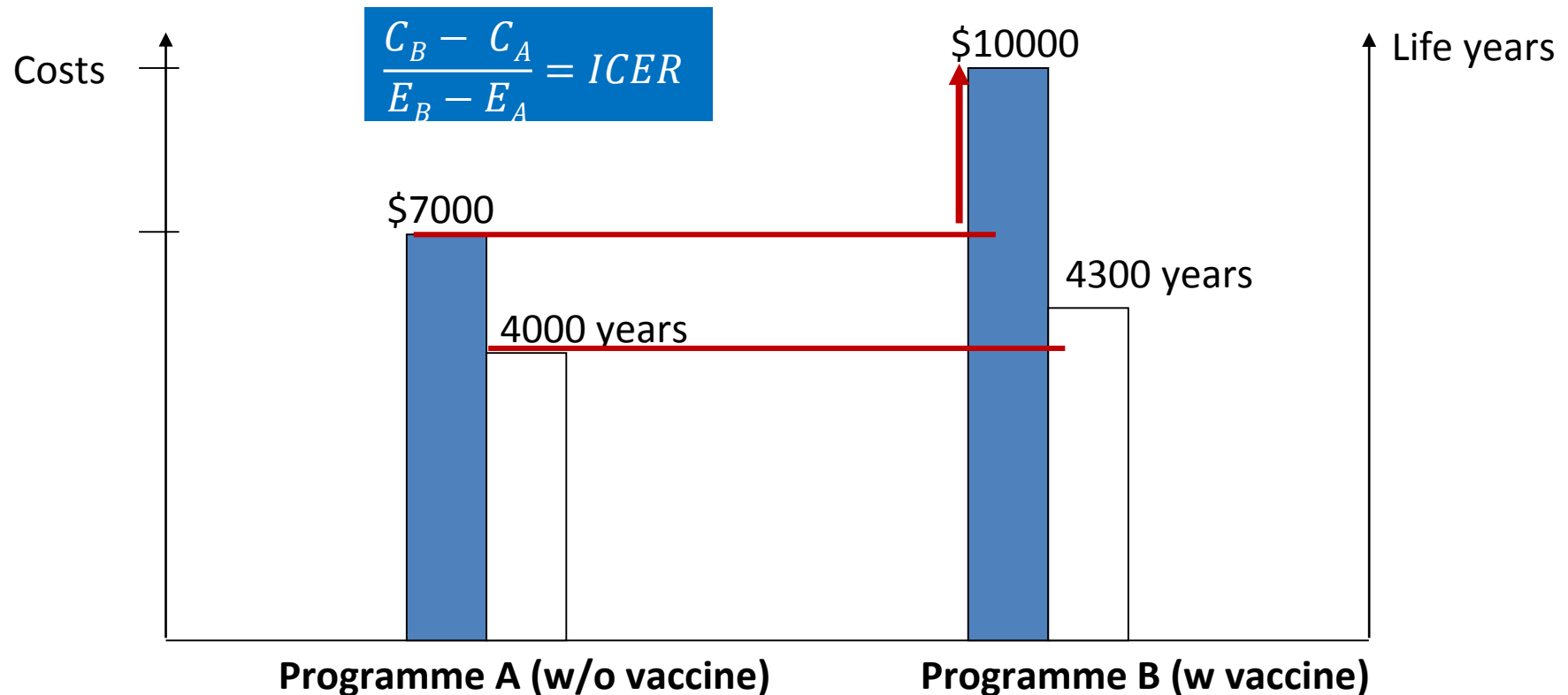
## Definition:

*“comparative analysis of alternative courses of action in terms of both costs and consequences”* (Drummond 2015)



- Allows systematic assessment of costs and consequences
- Enables evaluation of effects of various assumptions

# Incremental cost effectiveness ratio (ICER)



$$C_B - C_A / E_B - E_A = \$10000 - \$7000 / 4300 - 4000 \text{ years} = \$3000 / 300 \text{ years} = \$10/ \text{ year}$$

C = Costs of intervention E = Effectiveness / Outcome

# Different measures of effect / outcome in economic evaluations

- \$ per cervical cancer case avoided
- \$ per death avoided
- \$ per life-year gained

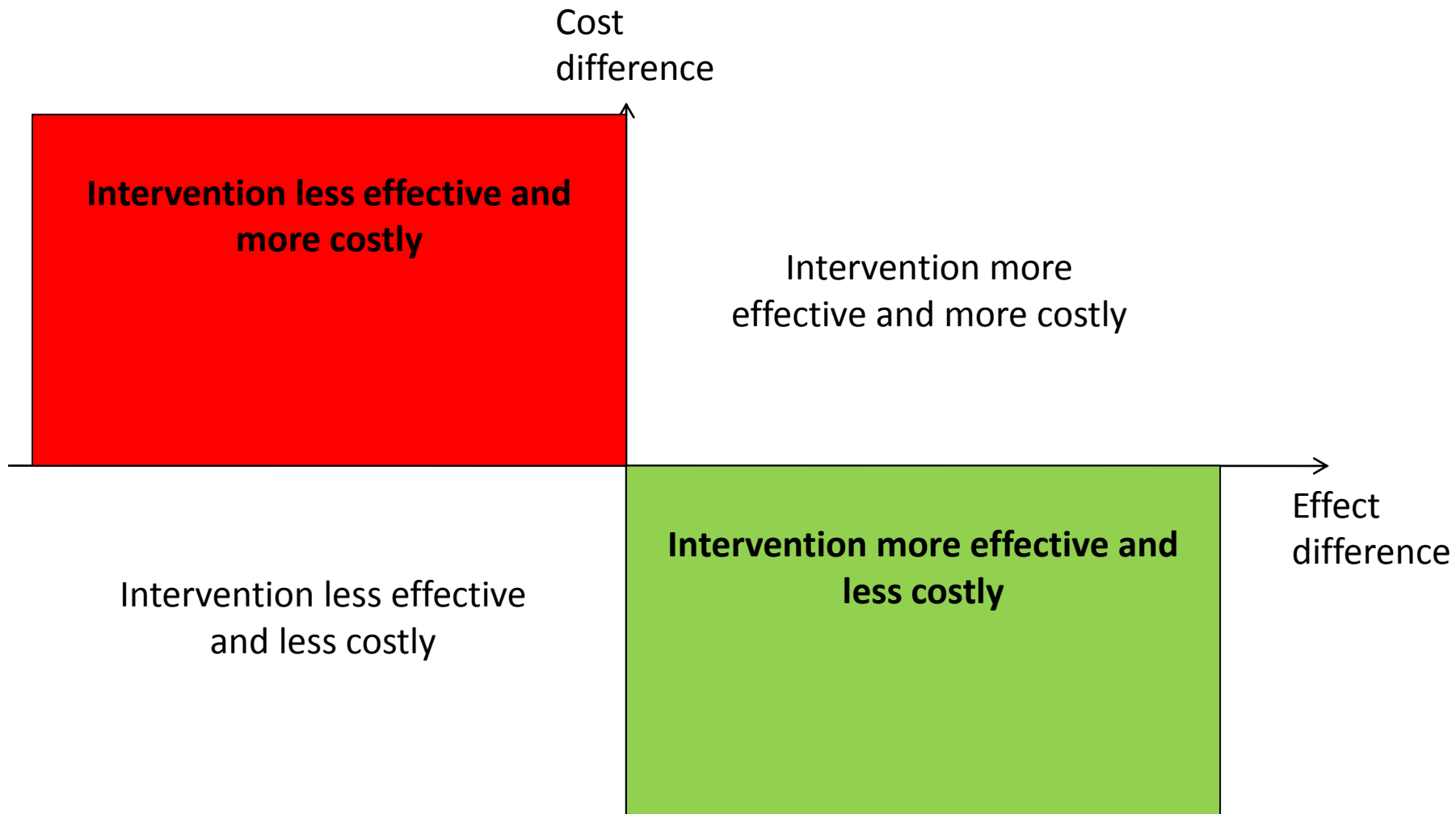
**Cost-effectiveness ratios**

- \$ per QALY gained
- \$ per DALY averted



**Cost-utility ratios**

*Incorporate both morbidity + mortality*

# Result of economic evaluation



# Methods: Two WHO tools were used

1. WHO Cervical Cancer Prevention and Control Costing (C<sub>4</sub>P) tool 
  - Estimating incremental costs of adding HPV vaccine the existing immunization program
2. Papillomavirus Rapid Interface for Modelling and Economics (PRIME) tool 
  - Economic evaluation of the effects of vaccine introduction



- Workshop in Moldova with various institutions



TASK 1: MICROPLANNING

TASK 2: VACCINES

TASK 3: TRAINING

TASK 4: SOCIAL MOBILISATION / IEC

TASK 5: SERVICE DELIVERY

TASK 6: SUPERVISION MONITORING

TASK 7: COLD CHAIN SUPPLEMENTAL

TASK 8: OTHER

C4P Data



**PRIME Tool**

Cohort size at vaccination age (female)
Cervical cancer incidence
Cervical cancer mortality
All cause mortality
Coverage (all doses)
Vaccine efficacy vs HPV 16/18
Vaccine price per FIG, delivery costs, total costs per FIG
Cancer treatment cost
DALYs for cancer diagnosis, non-terminal and terminal cancer
Discount rate
Cervical cancer cases due to HPV 16/18

# Data/Assumptions C4P: overview



(Cost-) category	Base case assumptions	Sources
Target group	# 10-y/o girls in 2015: 18,094 (→ 12-y/o in 2017)	National Bureau of Statistics
Vaccination coverage and drop out	First dose: 80%, Drop-out: 10%, 2 dose coverage: 72%	Based on coverage of existing programs
Microplanning	3 TAG meetings at US\$ 1,000 (financial) and US\$ 1,115 (economic)	Own assumptions
Vaccine	\$0 (with Gavi subsidy), \$4.50 (Gavi-price), 15% (add-on charges), 5% wastage, 20% buffer	Gavi, cMYP assumptions, EPI-person
Cold chain supplement	Sufficient excess capacity for HPV-vaccines	EPI-person
Training	Nurses: 45 workshops at US\$ 1,200 (financial) and 1,782 (economic) to train all nurses (n=1,768) Supervisors/Trainers: 4 workshops at US\$ 2,750 (financial) and US\$ 3,234 (economic) to train 35 supervisor/trainers	Salary and number of nurses: cMYP, # workshops: own assumptions
Social Mobilisation / IEC	Costs: US\$ 18,500	Gavi application
Service Delivery	15 min per vaccination in HF, nurse salary (3 872 lei per month)	Workshop discussions, EPI person, salary: cMYP key assumptions
Supervision/Monitoring and Evaluation	Monitoring of existing programs / divided by # of doses = US\$ 0.39 per dose; post-intro evaluation: US\$ 40,000	Monitoring: own assumptions, based on cMYP; Evaluation: Gavi application
Other	waste management: US\$ 10,000	Gavi application

# Data/Assumptions PRIME tool: overview



## PRIME Tool

Parameter	Base case assumptions	Source
Cohort size at vaccination age	18,094	National Bureau of Statistics
Cervical cancer incidence	Varies by age group. Crude all ages rate: 15.7 per 100 000 women	Cancer registry
Cervical cancer mortality	Increases with age: 4.2 to 26.6 (per 100 000)	Jit et al. 2014, based on GLOBOCAN 2012
All cause mortality	Varies by age group	National
Coverage (all doses)	72%	See C4P
Vaccine efficacy vs HPV 16/18	100%	WHO estimate
Vaccine price per FIG + delivery costs = total costs per FIG	US\$ 1.81 + 6.61 = 8.42 (fin) US\$ 13.85 + 7.21 = 21.06 (econ.)	C4P es
Cancer treatment cost	US\$ 2,071 (per episode over life-time)	Institute of Technology, life-time cost extrapolation (Ginsberg et al.)
DALYs for cancer diagnosis, non-terminal and terminal cancer	0.08, 0.13, 0.78	WHO estimate
Discount rate	3%	WHO
Cervical cancer cases due to HPV 16/18	84.8%	HPV information centre, regional estimate

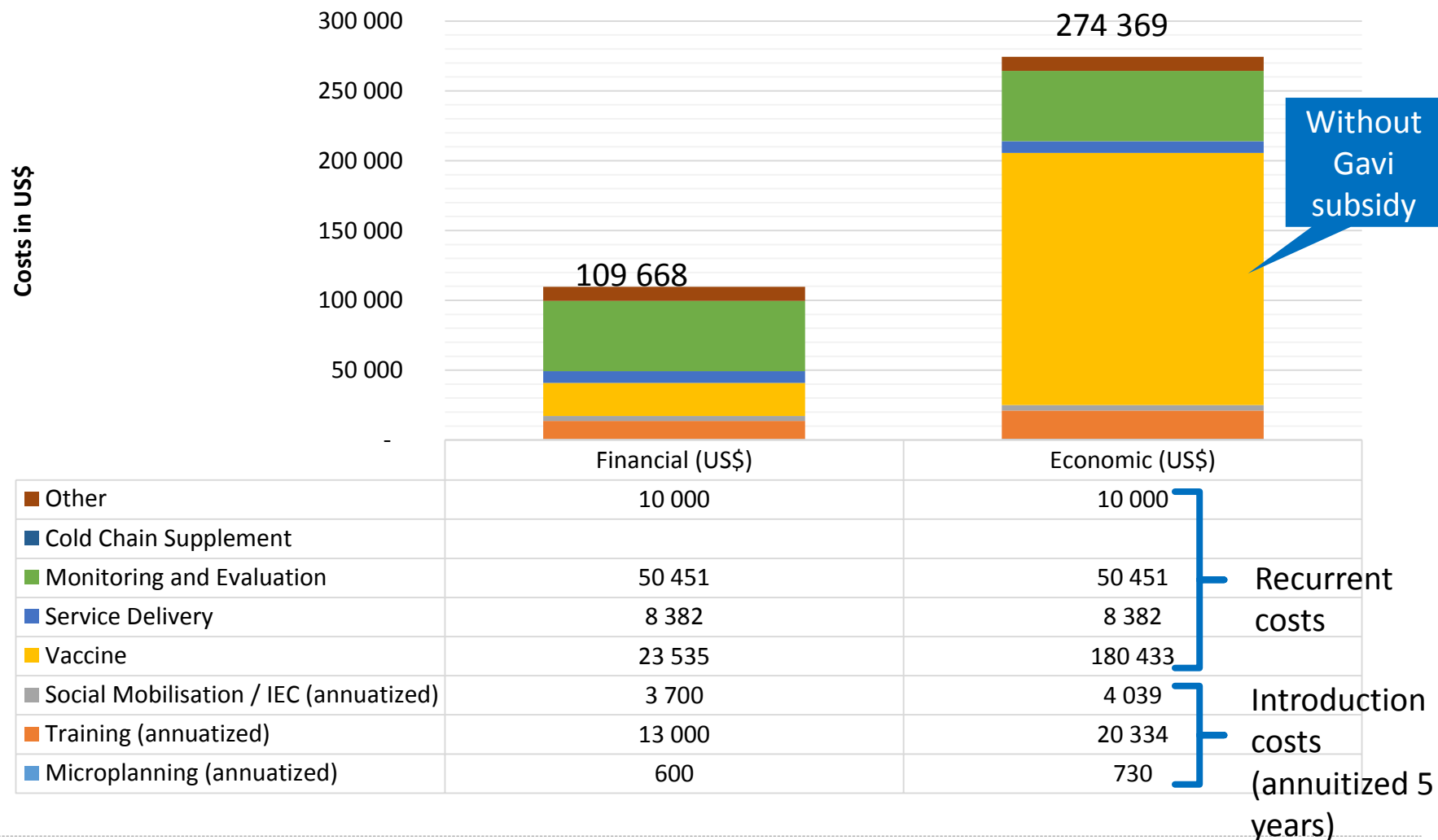
National data: only two age groups

Treatment costs according to protocol

Applied to costs and effects that will take place in the future

National data unavailable

# Results: costs of HPV vaccination



# Results: costs of HPV vaccination



## Results for planning and budgeting

- Annual recurrent costs
- Introduction costs

	Financial (US\$)	Economic (US\$)
Introduction costs (annuitized)	17300	25103
Recurrent costs	92,368	249,266
<b>Total costs</b>	<b>109 668</b>	<b>274 369</b>
<b>Introduction costs (total)</b>	<b>86,500</b>	<b>114.971</b>

## Results for economic evaluation

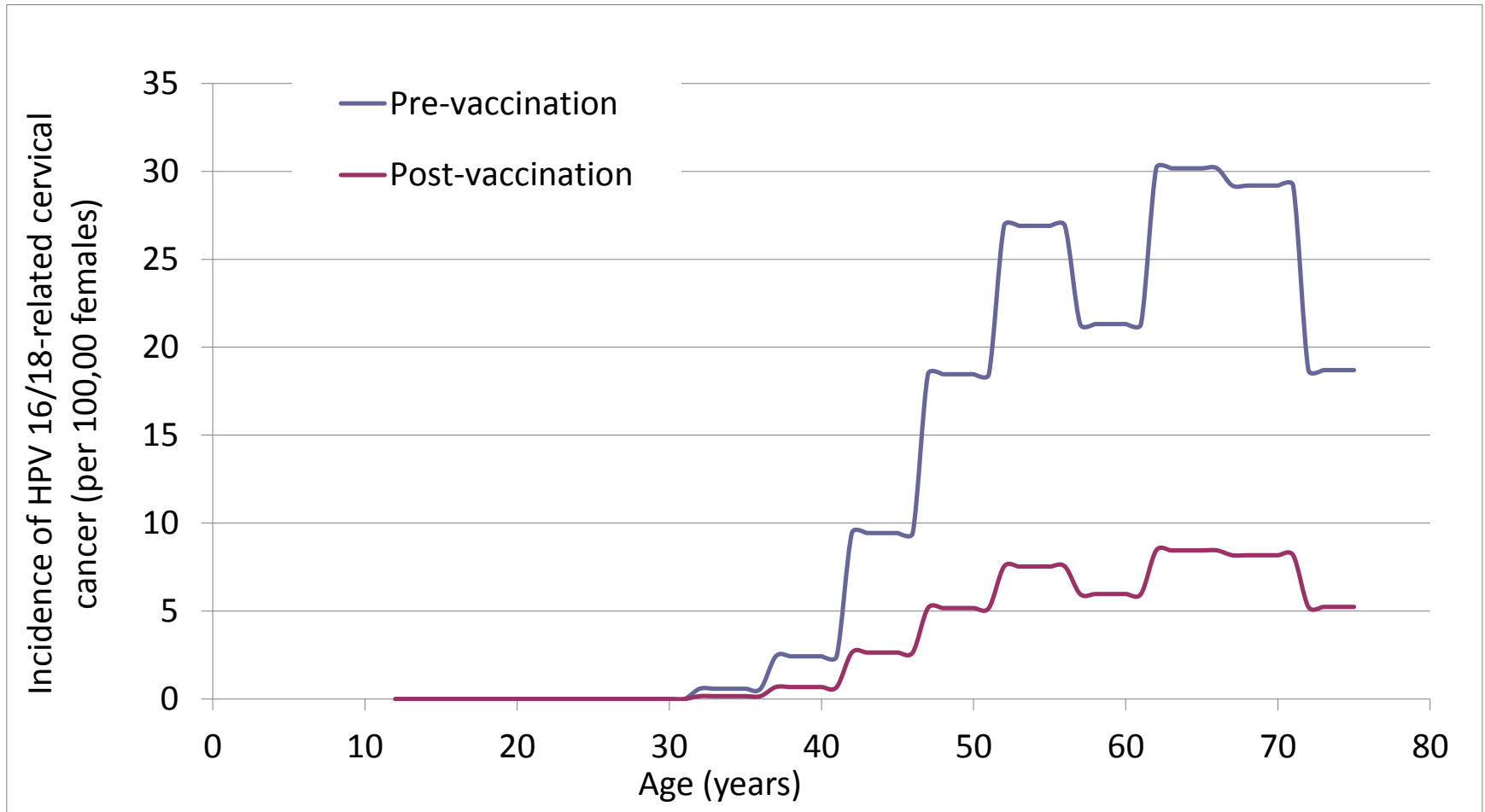
- Costs per does
- Costs per fully immunized girl (FIG)

	Financial (US\$)	Economic (US\$)
Cost per dose (27,503 doses)	3.99	9.98
Cost per FIG (13,028 girls)	8.42	21.06

# Results: effect of vaccination



PRIME Tool



# Results: economic evaluation



PRIME Tool

## Base Case Scenario

	Financial		Economic	
	Undiscounted	Discounted (3.0%)	Undiscounted	Discounted (3.0%)
Cost of vaccination	US\$ 109,693	US\$ 109,693	US\$ 274,363	US\$ 274,363
Treatment costs saved	US\$ 263,965	US\$ 83,196	US\$ 263,965	US\$ 83,196
Net cost	-US\$ 156,272	US\$ 26,497	US\$ 10,398	US\$ 191,167
Cervical cancers prevented	127	40	127	40
Deaths prevented	98	28	98	28
Life years saved	2,158	676	2,158	676
Nonfatal DALYs prevented	102	30	102	30

# Results: economic evaluation



PRIME Tool

## Base Case Scenario

	Financial		Economic	
	Undiscounted	Discounted (3.0%)	Undiscounted	Discounted (3.0%)
Incremental cost per...				
... cervical cancer prevented	-US\$ 1,210	US\$ 660	US\$ 82	US\$ 4,759
... life saved	-US\$ 1,577	US\$ 937	US\$ 106	US\$ 6,758
... life year saved	-US\$ 71	US\$ 39	US\$ 5	US\$ 283
... DALY prevented	-US\$ 68	US\$ 38	US\$ 5	US\$ 271



cost saving



Costs per life year saved < GDP per capita



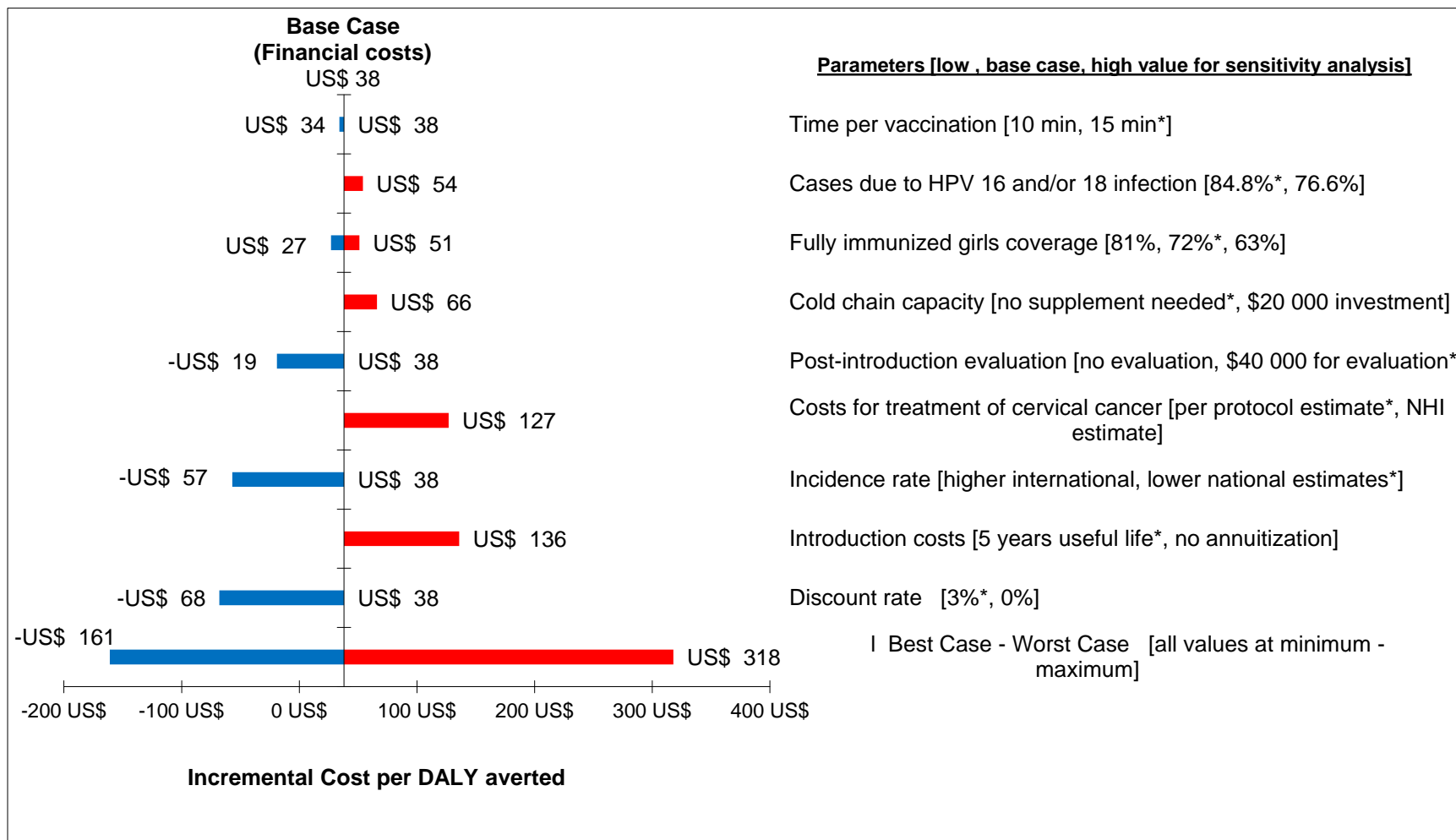


# Sensitivity Analysis: Alternative assumptions

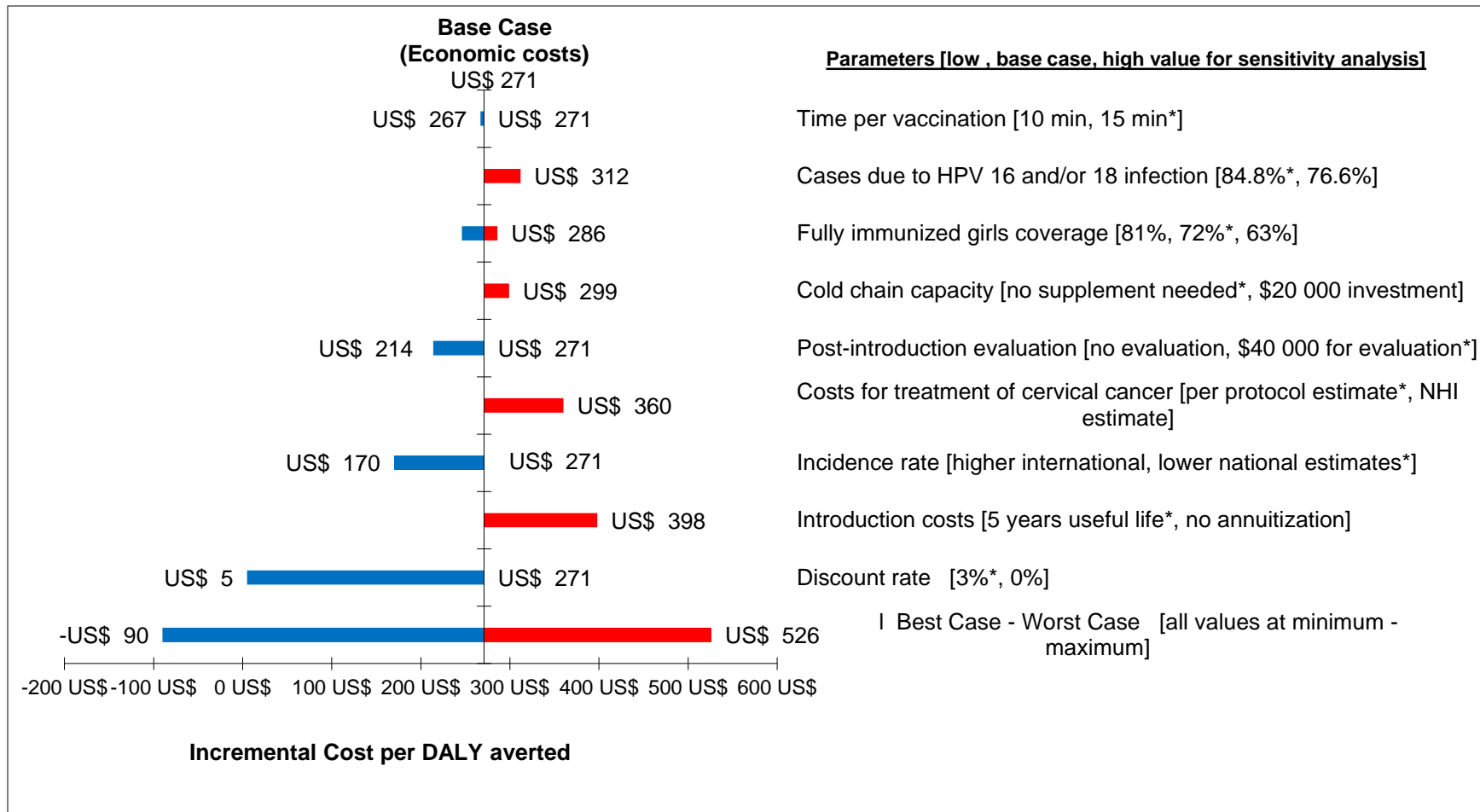
	Best case scenario	Worst case scenario
Incidence rate	High rates (international estimates, based on HPV information centre)	Low rates (national estimates)*
Vaccination coverage all doses	81% (90% first dose, 10% drop out)	63% (70% first dose, 10% drop out)
Cancer treatment cost (per episode, over lifetime)	High costs, assumptions based on estimates from institute of oncology*	Low costs, assumptions based on national health insurance.
Proportion of cervical cancer cases due to HPV 16/18	High proportion, estimates for Eastern Europe*	Low proportion, international estimates (based on Jit et al.)
Service delivery – time per vaccination	10 Minutes	15 Minutes*
Introduction costs annualized (5 years, 3% discounting)	Annualized*	Not annualized
Cold chain costs	No additional costs*	\$US 20,000 (based on Gavi application)
Costs for Evaluation	No additional costs	\$US 40,000*

\* value used in base case analysis

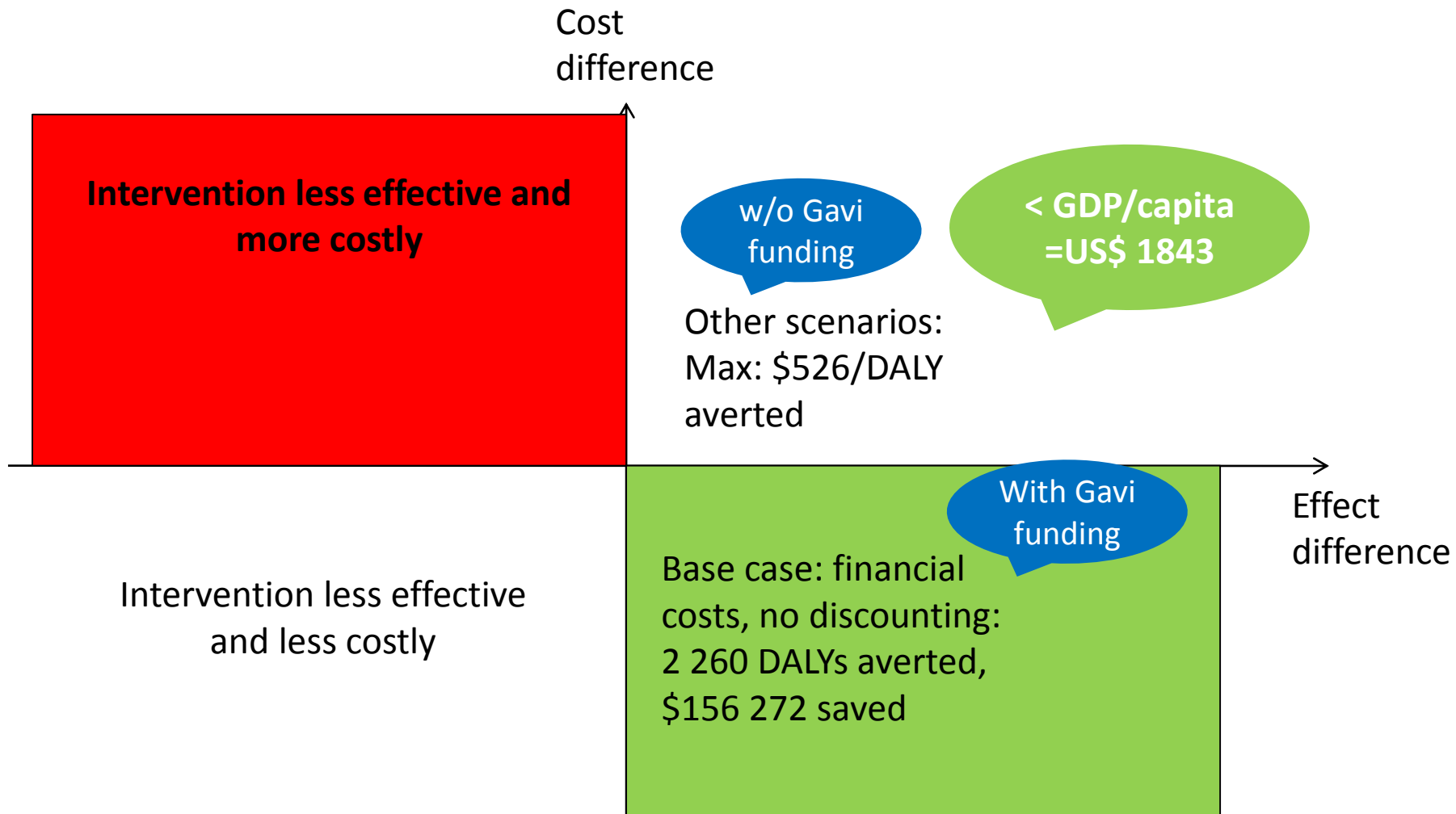
# Sensitivity analysis: results for financial costs



# Sensitivity analysis: results for economic costs



# Summary



- Results indicate that HPV vaccination is a cost-effective intervention in Moldova
- Several limitations
  - Model does not incorporate effects of current/future screening → would lead to lower incidence and earlier detection
  - Modelling was based on numerous assumptions and relatively weak data sources → nevertheless conclusions robust in sensitivity analyses

- HPV introduction is likely to be a cost-effective strategy
- With Gavi subsidy, HPV vaccination will improve health at no or very low extra costs
- Including vaccine costs at Gavi prices, and most unfavourable assumptions: costs / DALY averted are US\$526 → well below national GDP/capita → cost effective

Спасібо!

Thank you very much!

[www.mig.tu-berlin.de](http://www.mig.tu-berlin.de)

[http://www.who.int/immunization/diseases/hpv/cervical\\_cancer\\_costing\\_tool/en/](http://www.who.int/immunization/diseases/hpv/cervical_cancer_costing_tool/en/)

<http://primetool.org/about-hpv/>

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